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AUTO-TREND USER'S GUIDE

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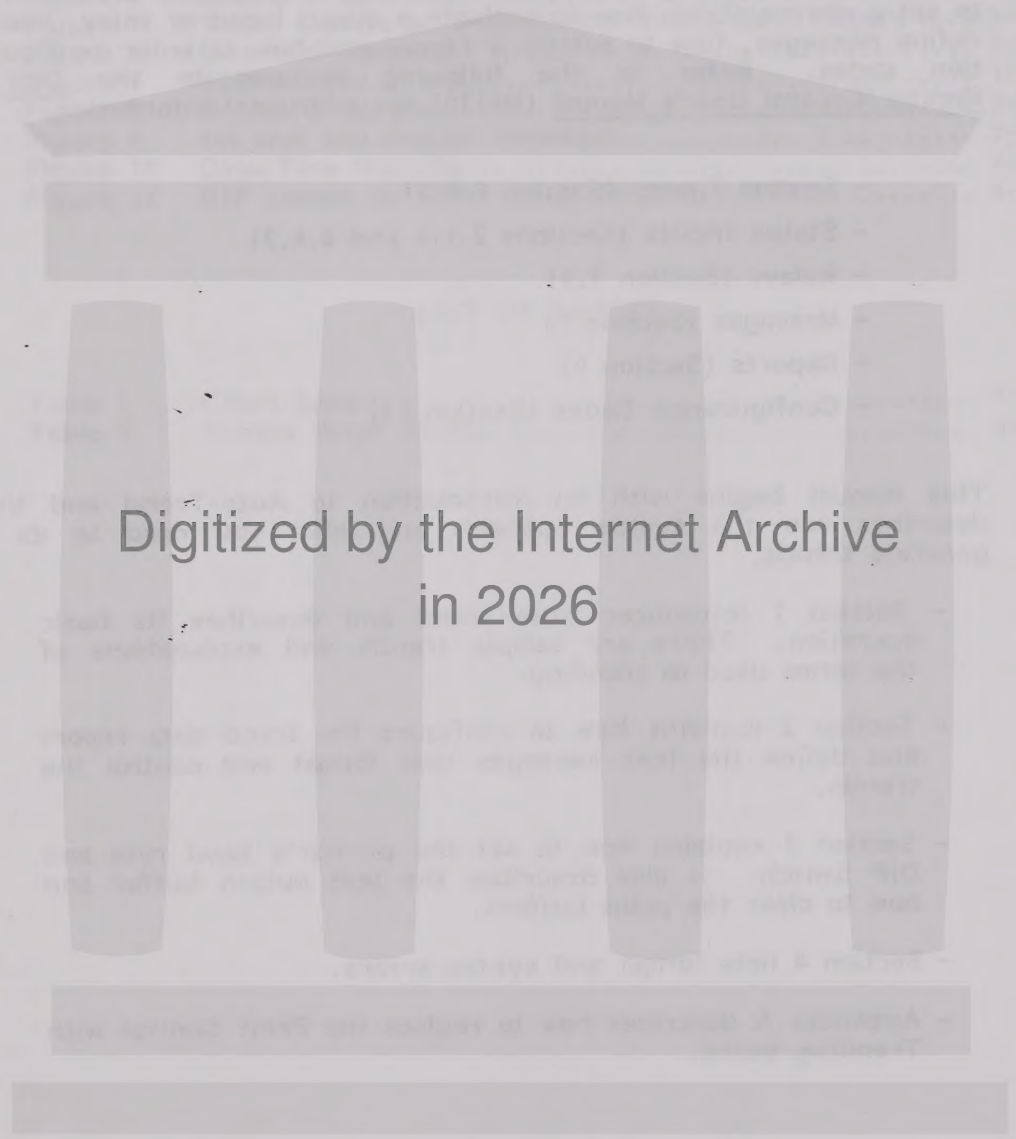
INTRODUCTION

This manual explains how to configure an Auto-Trend report with the Digistrip 4. To successfully use Auto-Trend, you should be familiar with basic Digi 4 programming. In particular, you need to know how to set a system timer, how to activate a status input or relay, how to define messages, how to set up a report and how to enter configuration codes. Refer to the following sections in the Digi 4 Monitor/Control User's Manual (M4130) for additional information.

- System Timers (Section 6.4.3)
- Status Inputs (Sections 2.1.4 and 6.4.2)
- Relays (Section 7.2)
- Messages (Section 8)
- Reports (Section 9)
- Configuration Codes (Section 11)

This manual begins with an introduction to Auto-Trend and then describes how the system operates and what you need to do to generate trends.

- Section 1 introduces Auto-Trend and describes its basic operation. There are sample trends and explanations of the terms used in trending.
- Section 2 explains how to configure the trend data report and define the text messages that format and control the trends.
- Section 3 explains how to set the printer's baud rate and DIP Switch. It also describes the text output buffer and how to clear the print buffers.
- Section 4 lists format and syntax errors.
- Appendix A describes how to replace the Print Control with Trending board.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SECTION 1 - INTRODUCTION TO AUTO-TREND

Kaye's Auto-Trend package has the industrial graphics you requested! The Digistrip 4's built-in printer can print both trends and standard data reports.

Digistrip 4 can trend live or historical data from up to 32 different data points (channels). Use Auto-Trend to graph analog inputs such as temperatures, pressures and flows, calculated values, such as totals and efficiencies, or analog outputs. Because you define the format, contents and triggers of each trend, you can set up different ways of looking at the same data. The system can generate 9 separate trends from the 32 channels you select.

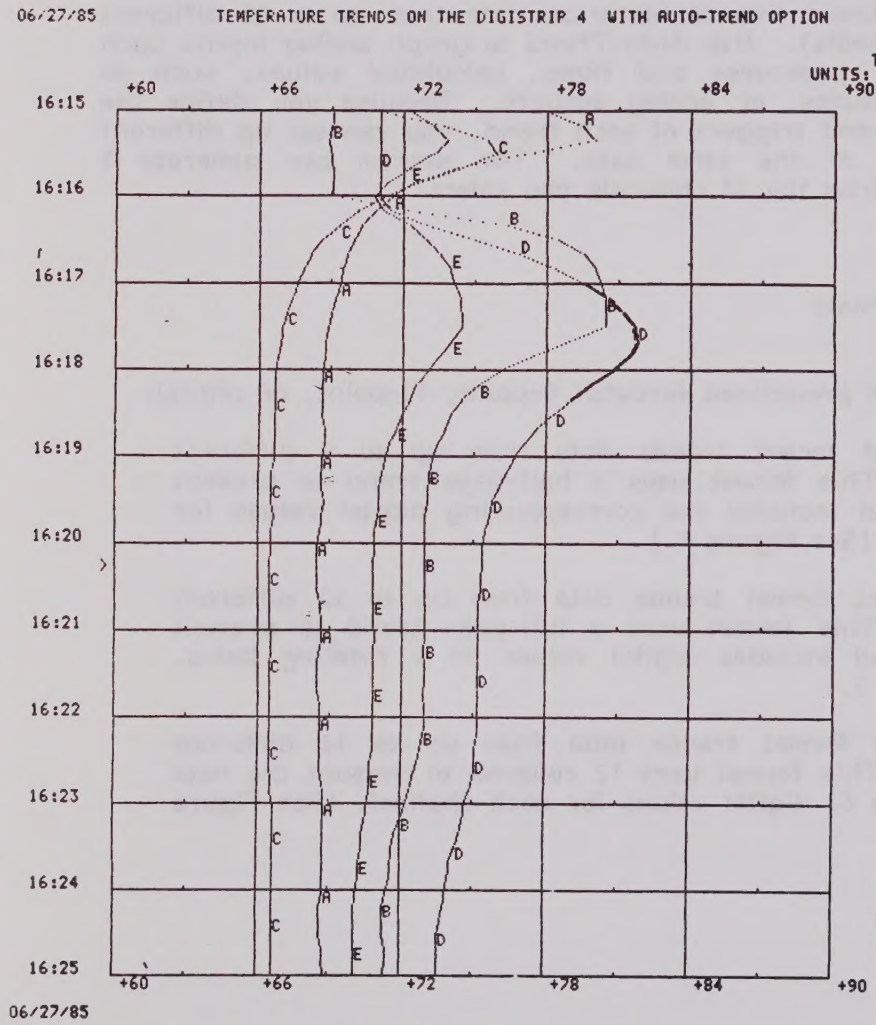
1.1 Trending Formats

Auto-Trend has 3 predefined formats: 6-point, 12-point, or digital.

- The 6-point format trends data from up to 6 different channels. This format uses a half-page trend to present the data and includes the corresponding digital values for each point. (See Figure 1.)

- The 12-point format trends data from up to 12 different channels. This format uses a full-page trend to present the data and includes digital values on a rotating basis. (See Figure 2.)

- The digital format tracks data from up to 12 different channels. This format uses 12 columns to present the data and displays 61 digital values for each channel. (See Figure 3.)



SUMMARY: LIVE, HDR1, TRIGOO, FAST, CS06

UNITS: F

A TEMP 1	B TEMP 2	C TEMP 3	D TEMP 4	E AVG TEMP
78.0	69.1	71.0	71.1	72.3
79.5	69.0	73.7	71.1	73.3
80.1	68.9	75.6	71.1	73.9
77.4	69.0	75.5	71.1	73.3
74.3	69.1	74.5	71.1	72.3
72.6	69.1	72.8	71.1	71.4
71.6	69.1	71.3	71.1	70.8
70.9	72.2	70.2	71.5	71.2
70.3	76.4	69.4	73.0	72.3
70.0	78.5	68.7	75.0	73.0
69.7	79.6	68.2	76.9	73.6
69.5	80.1	67.9	78.4	74.0
69.4	80.3	67.6	79.6	74.2
69.2	80.5	67.4	80.6*	74.4
69.0	80.5	67.2	81.2*	74.5
68.9	80.5	67.0	81.7*	74.5
68.8	79.0	66.9	81.8*	74.1
68.8	77.5	66.8	81.5*	73.6
68.7	76.1	66.7	80.8*	73.1
68.7	75.2	66.7	79.9*	72.6
68.7	74.5	66.7	79.1*	72.3
68.7	74.1	66.7	78.4	72.0
68.8	73.8	66.7	77.7	71.8
68.8	73.5	66.7	77.2	71.5
68.7	73.3	66.7	76.7	71.3
68.7	73.2	66.6	76.4	71.2
68.7	73.1	66.6	76.1	71.1
68.8	73.1	66.6	75.8	71.1
68.7	73.0	66.7	75.7	71.0
68.6	73.0	66.6	75.5	70.9
68.5	73.0	66.6	75.4	70.9
68.5	73.0	66.5	75.4	70.8
68.5	73.0	66.5	75.3	70.8
68.5	73.0	66.5	75.3	70.8
68.6	73.0	66.5	75.2	70.8
68.6	73.0	66.5	75.2	70.8
68.7	73.0	66.6	75.2	70.9
68.6	72.9	66.6	75.2	70.8
68.5	73.0	66.5	75.2	70.8
68.5	73.0	66.5	75.2	70.8
68.5	72.9	66.5	75.2	70.8
68.6	73.0	66.5	75.2	70.8
68.6	73.0	66.5	75.2	70.8
68.6	72.9	66.5	75.2	70.8
68.6	72.8	66.5	75.1	70.8
68.6	72.7	66.5	75.1	70.7
68.7	72.5	66.6	75.0	70.7
68.8	72.4	66.6	74.9	70.7
68.8	72.2	66.7	74.7	70.6
68.8	72.0	66.7	74.6	70.5
68.8	71.8	66.7	74.5	70.4
68.8	71.7	66.7	74.3	70.4
68.8	71.6	66.7	74.1	70.3
68.8	71.6	66.7	74.0	70.3
68.8	71.4	66.7	73.9	70.2
68.7	71.3	66.7	73.8	70.1
68.7	71.3	66.7	73.7	70.1
68.7	71.3	66.7	73.6	70.1
68.8	71.4	66.7	73.6	70.1
68.8	71.4	66.7	73.6	70.1
68.9	71.3	66.7	73.5	70.1

PAGE 0

Figure 1. 6-Point Format

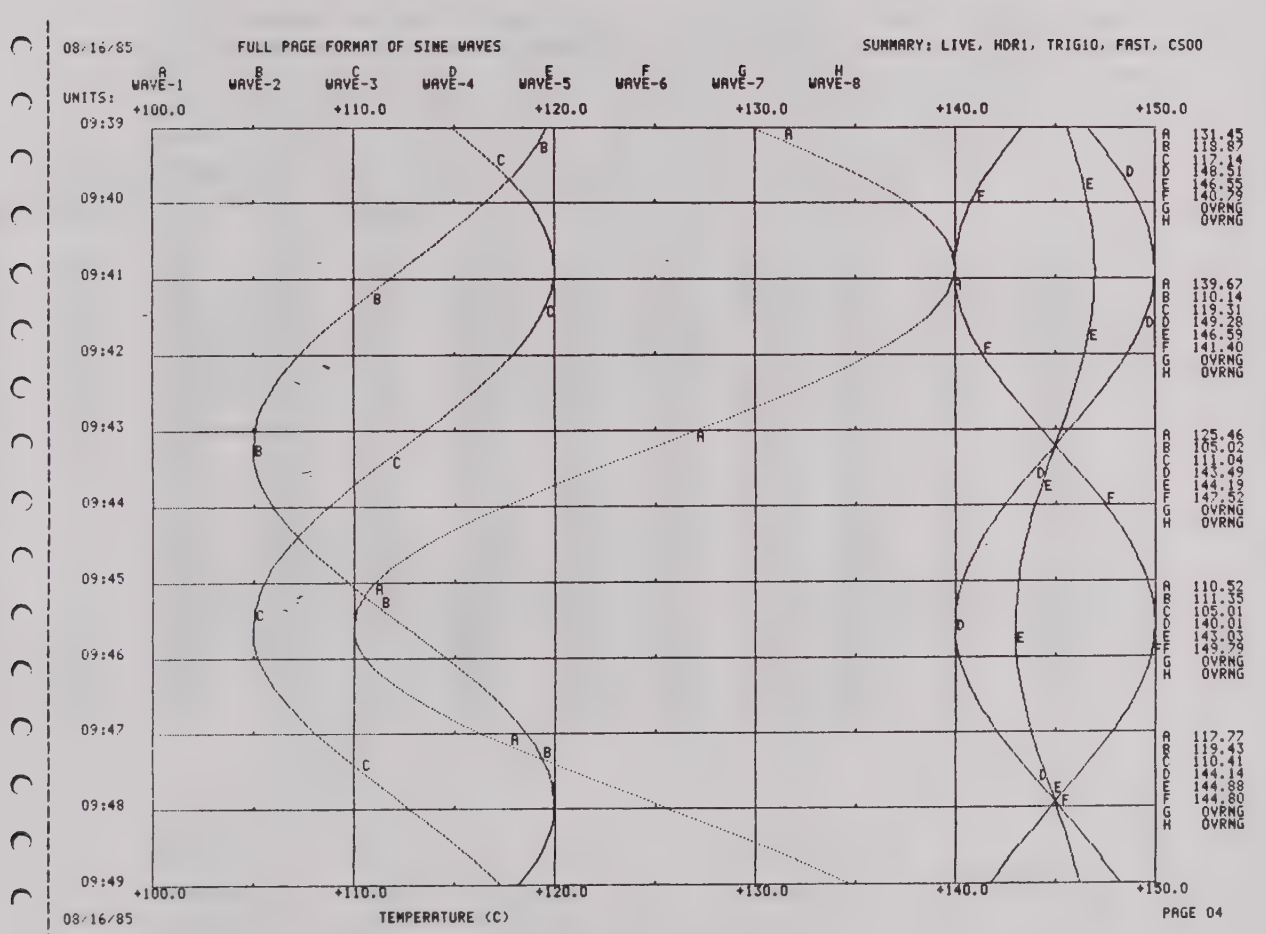
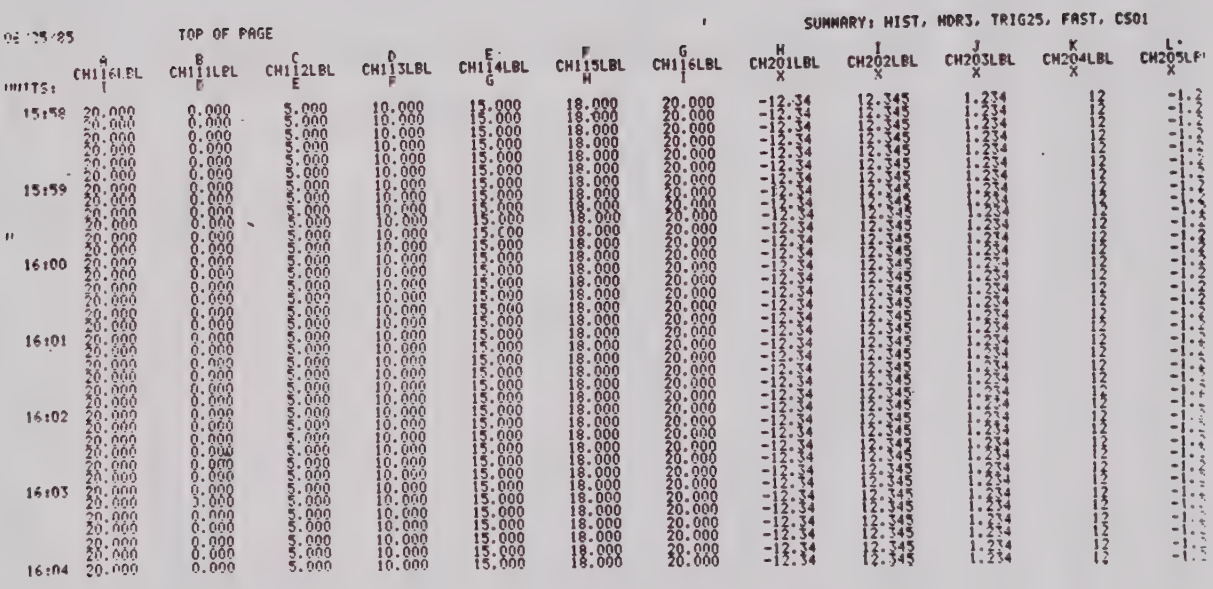


Figure 2. 12-Point Format



SUMMARY: HIST, HDR3, TRIG25, FAST, CS01

TOP OF PAGE

	A	B	C	D	E	F	G	H	I	J	K	L
	CH116LBL	CH111LBL	CH112LBL	CH113LBL	CH114LBL	CH115LBL	CH116LBL	CH201LBL	CH202LBL	CH203LBL	CH204LBL	CH205LBL
UNITS:	I	D	E	F	G	H	I	X	X	X	X	X
15:58	20.000	0.000	5.000	10.000	15.000	18.000	20.000	-12.34	12.345	1.234	12	-1.2
	20.000	0.000	5.000	10.000	15.000	18.000	20.000	-12.34	12.345	1.234	12	-1.2
	20.000	0.000	5.000	10.000	15.000	18.000	20.000	-12.34	12.345	1.234	12	-1.2
	20.000	0.000	5.000	10.000	15.000	18.000	20.000	-12.34	12.345	1.234	12	-1.2
	20.000	0.000	5.000	10.000	15.000	18.000	20.000	-12.34	12.345	1.234	12	-1.2
15:59	20.000	0.000	5.000	10.000	15.000	18.000	20.000	-12.34	12.345	1.234	12	-1.2
	20.000	0.000	5.000	10.000	15.000	18.000	20.000	-12.34	12.345	1.234	12	-1.2
	20.000	0.000	5.000	10.000	15.000	18.000	20.000	-12.34	12.345	1.234	12	-1.2
	20.000	0.000	5.000	10.000	15.000	18.000	20.000	-12.34	12.345	1.234	12	-1.2
"	20.000	0.000	5.000	10.000	15.000	18.000	20.000	-12.34	12.345	1.234	12	-1.2
	20.000	0.000	5.000	10.000	15.000	18.000	20.000	-12.34	12.345	1.234	12	-1.2
16:00	20.000	0.000	5.000	10.000	15.000	18.000	20.000	-12.34	12.345	1.234	12	-1.2
	20.000	0.000	5.000	10.000	15.000	18.000	20.000	-12.34	12.345	1.234	12	-1.2
	20.000	0.000	5.000	10.000	15.000	18.000	20.000	-12.34	12.345	1.234	12	-1.2
	20.000	0.000	5.000	10.000	15.000	18.000	20.000	-12.34	12.345	1.234	12	-1.2
	20.000	0.000	5.000	10.000	15.000	18.000	20.000	-12.34	12.345	1.234	12	-1.2
16:01	20.000	0.000	5.000	10.000	15.000	18.000	20.000	-12.34	12.345	1.234	12	-1.2
	20.000	0.000	5.000	10.000	15.000	18.000	20.000	-12.34	12.345	1.234	12	-1.2
	20.000	0.000	5.000	10.000	15.000	18.000	20.000	-12.34	12.345	1.234	12	-1.2
	20.000	0.000	5.000	10.000	15.000	18.000	20.000	-12.34	12.345	1.234	12	-1.2
	20.000	0.000	5.000	10.000	15.000	18.000	20.000	-12.34	12.345	1.234	12	-1.2
16:02	20.000	0.000	5.000	10.000	15.000	18.000	20.000	-12.34	12.345	1.234	12	-1.2
	20.000	0.000	5.000	10.000	15.000	18.000	20.000	-12.34	12.345	1.234	12	-1.2
	20.000	0.000	5.000	10.000	15.000	18.000	20.000	-12.34	12.345	1.234	12	-1.2
	20.000	0.000	5.000	10.000	15.000	18.000	20.000	-12.34	12.345	1.234	12	-1.2
	20.000	0.000	5.000	10.000	15.000	18.000	20.000	-12.34	12.345	1.234	12	-1.2
16:03	20.000	0.000	5.000	10.000	15.000	18.000	20.000	-12.34	12.345	1.234	12	-1.2
	20.000	0.000	5.000	10.000	15.000	18.000	20.000	-12.34	12.345	1.234	12	-1.2
	20.000	0.000	5.000	10.000	15.000	18.000	20.000	-12.34	12.345	1.234	12	-1.2
	20.000	0.000	5.000	10.000	15.000	18.000	20.000	-12.34	12.345	1.234	12	-1.2
	20.000	0.000	5.000	10.000	15.000	18.000	20.000	-12.34	12.345	1.234	12	-1.2
16:04	20.000	0.000	5.000	10.000	15.000	18.000	20.000	-12.34	12.345	1.234	12	-1.2

Figure 3. Digital Format

The grid layout of the 6-point and 12-point trends makes it easy to reference and identify data. Horizonal lines, called time stamp lines, give the hour and minute of selected data points. The time stamp depends on the chart speed you select. The chart speed also determines the interval between data samples. (See Section 1.4 for an explanation of the chart speed.)

The period between time stamps is called the time stamp interval. There are either 5 or 6 points in a time stamp interval. The number of points in the time stamp interval depends on the print buffer generating the trend. (See Section 1.3 for an explanation of the print buffers.) To provide smooth plot lines, Auto-Trend automatically inserts 7 dots between each pair of points. Auto-Trend also uses triple wide lines to indicate an alarm condition.

The vertical lines are references. They help you determine the value of the data point. You specify the value of the left and right margins (maximum of 5 digits, sign and decimal point) and the system calculates the values of the four intermediate lines. These values are printed at the top and bottom of the trend and are called the x-axis references.

If the value of a point is outside the range defined by the left and right margins, the point is not plotted. The system prints the corresponding digital data, even if it is off scale, per the selected format. The 6-point format prints digital values for each point; the 12-point format prints digital values on a rotating basis.

Note:
An error occurs if the value of the left margin is equal to or greater than the value of the right margin.

If the value of a point is OPEN or OVER-RANGE, the point is not plotted and OPEN or OVRNG appears instead of the digital data. If there is no data available; i.e., no function code is assigned, UNPROG appears instead of the digital data.

The date of the first point plotted, a top-of-page title and a trend summary appear at the top of each page. The summary specifies live or historical mode, identifies the trend (1-9) and its trigger, indicates whether the data is from the fast or slow print buffer and specifies the chart speed. You can also define a bottom-of-page title for each trend and an 8-character label and units identifier for each data point. To further simplify data identification and referencing, a letter accompanies each plot line.

- The 6-point format places a letter (A-F) to the right of the plot line. "A" identifies the 1st channel, "B" the 2nd, etc. The same letters (A-F) also head the columns of digital data.

- The 12-point format places a letter (A-L) to the right of the plot line. "A" identifies the 1st channel, "B" the 2nd, etc. The same letters (A-L) also appear on a rotating basis in a single column to the right of the trend. The digital value of the corresponding point follows the letter. The column begins with "A" and rotates through all of the channels (A-L). If fewer than 12 channels are in the trend, the system inserts blank spaces until it reaches a time stamp line and then begins again with "A".

- The 12 column digital format places a letter (A-L) at the top of each column. The letters A-L identify the channels in the trend. "A" corresponds to the 1st channel, "B" the 2nd, etc.

1.2 Trend Data Report

The trend data report supplies the data for all trends. You can select any standard Digi 4 data report as the trend data report. Special control characters identify (bracket) the trend data report. These control characters are stored in the start of text (STX) and the end of text (ETX) messages. Section 2.3 explains how to enter the STX and ETX messages.

- The STX message precedes the trend data report and must contain a left bracket "[" and a dollar sign "$". When you enter the STX message, key in 5B24. This is the hexadecimal equivalent of "[" and "$".
- The ETX message follows the trend data report and must contain a right bracket "]". When you enter the ETX message, key in 5D. This is the hexadecimal equivalent of "]".

When the printer sees "[$", it knows that the data that follows is trend data. STX and ETX messages should only appear at the beginning and end of the trend data report. If they appear in other locations or are incorrectly defined, trending will not operate.

Trending is a synchronized operation and requires that the trend data report be generated at 10 or 20 second intervals and be configured in a fixed format. Section 2.2 explains how to configure the trend data report and Section 2.4 explains how to set a system timer.

The trend data report supplies the data, format and triggers for up to 9 trends. The system only prints the contents of the trend data report the first time the printer receives it, if you change a parameter or if you enter an incorrect parameter. Figure 4 shows a sample trend data report.

You select the data (2 rows of 16 channels) that goes into the trend data report. Even if you want to trend fewer than 16 data points, the trend data report must still contain 2 rows of data or an error occurs. The rows do not have to be consecutive. For example, you can select the trend data from row 100 (Channels 101-116) and row 300 (Channels 301 to 316).

The trend data report must also contain the states of the relays and status inputs. The relays and status inputs trigger trending, select the print buffer and clear trend data. A value of 1 indicates that the relay or status input is ON; 0 indicates that the relay or status input is OFF. (See Section 1.6 for more information about triggers.)

You can define 9 trends from the 32 channels included in each trend data report. Each header line in the trend data report defines one trend. A header line consists of 128 characters. Each character or group of characters has a unique purpose. Section 2.2, Setting the Configuration Codes (Configuration Code 014, 024, 034, 044), explains how to configure the report header. Section 2.3, Entering Text Messages, lists the exact purpose of each character in the header.

The date/time message also supplies important trending instructions. This message specifies the chart speed, which print buffer supplies the data for the trend, how the print buffers are cleared and directions to abbreviate the trend. Section 2.2, Setting the Configuration Codes (Configuration Code 015, 025, 035, 045) selects the date/time message. Section 2.3, Entering Text Messages, lists the exact purpose of each character in the date/time message.

Figure 4 shows a sample trend data report and identifies:

- The STX message
- Header line (including top and bottom of page titles)
- Date/time message
- Trend data from rows 300 and 400
- Labels for each data point
- ON/OFF states of the relays and status inputs
- The ETX message

Figure 5 shows a trend generated from this trend data report. The trend contains 6 plot lines (A-F) and represents the data at Channel Addresses 301 to 306.

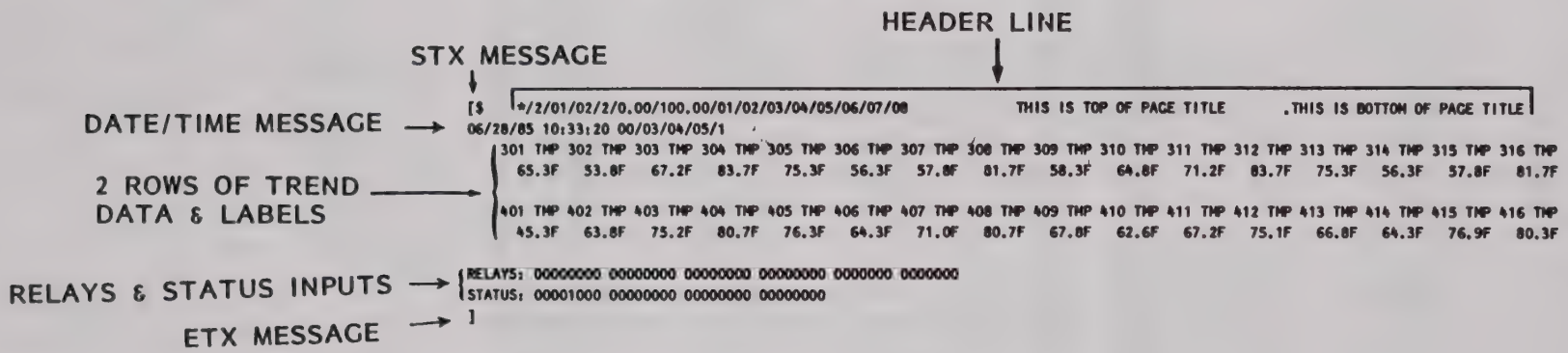


Figure 4. Sample Trend Data Report

The STX MESSAGE contains the control characters [$ and defines the beginning of the trend data report.

Each HEADER LINE begins with an asterisk (*) and defines one trend. A header line is made up of four 32-character messages for a total of 128 characters. Each character in the header has a unique purpose. The first two messages (64 characters) define the format, triggers, high and low scales, and the points to be trended. The third message defines the top of page title. The forth message can either add to the top of page title, or if preceded by a ".", it defines the bottom of page title.

The DATE/TIME MESSAGE specifies the chart speed and three triggers. The chart speed determines how often to generate the trend data report and when trend data is copied from the fast to the slow print buffer. The three triggers specify which print buffer is used (fast or slow) and when to clear the print buffer. The date/time message also specifies whether or not to abbreviate a trend if a higher priority trigger is activated, if the printer detects a format change or error, or if another Digi printout is received.

The 2 ROWS OF TREND DATA & LABELS supply the data for trending.

The RELAYS AND STATUS INPUTS update the triggers.

The ETX MESSAGE contains the control character] and defines the end of the trend data report.

[# */1/01/02/2/-50.00/125.00/01/02
06/28/85 10:33:10 00/03/04/05/1

THIS IS A TOP OF PAGE TITLE.....THIS IS A BOTTOM OF PAGE TITLE

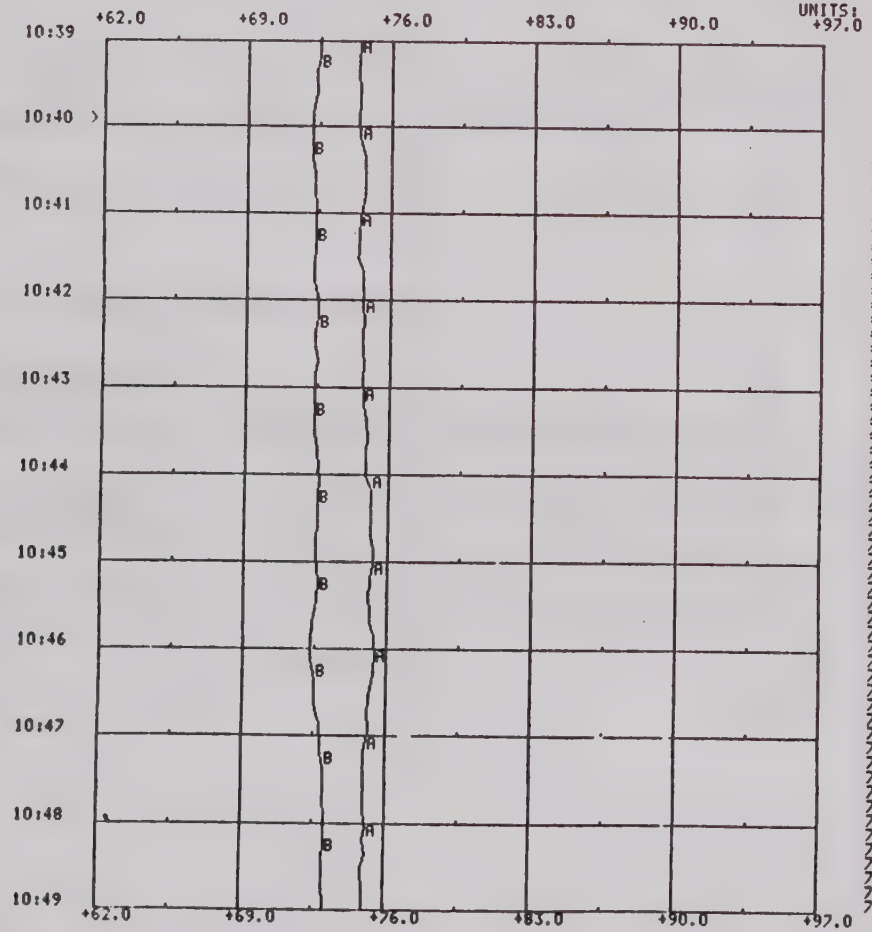
	301 TMP	302 TMP	303 TMP	304 TMP	305 TMP	306 TMP	307 TMP	308 TMP	309 TMP	310 TMP	311 TMP	312 TMP	313 TMP	314 TMP	315 TMP	316 TMP
300	-12.4F	-19.6F	8.6F	12.8F	89.3F	41.0F	101.5F	121.3F	141.7F	69.	20.7	-33.8F	4.6F	108.0F	119.5F	160.9F

	401 TMP	402 TMP	403 TMP	404 TMP	405 TMP	406 TMP	407 TMP	408 TMP	409 TMP	410 TMP	411 TMP	412 TMP	413 TMP	414 TMP	415 TMP	416 TMP
400	11.1	-25.0F	-22.6F	99.3F	56.9F	79.2F	4.9F	56.8F	-1.9F	-11.1F	28.3F	12.5F	127.7F	94.1F	101.8F	109.3F

RELAYS: 00000000 00000000 00000000 00000000 00000000 00000000
STATUS: 00001000 00000000 00000000 00000000
]

**** GRAPHIC REPORT FORMAT CHANGE ****

07/26/85 THIS IS A TOP OF PAGE TITLE..... SUMMARY: LIVE, HDR1, TRIG10, FAST, C500



UNITS:	A F	B F
+97.0	24.5	22.5
	24.4	22.5
	24.4	22.4
	24.5	22.4
	24.5	22.3
	24.4	22.2
	24.5	22.2
	24.6	22.2
	24.8	22.2
	24.8	22.3
	24.8	22.3
	24.7	22.4
	24.6	22.4
	24.5	22.4
	24.5	22.4
	24.4	22.4
	24.7	22.3
	24.7	22.4
	24.7	22.4
	24.8	22.5
	24.7	22.4
	24.7	22.4
	24.8	22.4
	24.8	22.4
	24.9	22.4
	25.0	22.4
	24.9	22.5
	24.9	22.6
	24.9	22.7
	25.2	22.6
	25.2	22.6
	25.2	22.6
	25.2	22.5
	25.3	22.5
	25.3	22.6
	25.2	22.7
	25.1	22.6
	25.2	22.5
	25.2	22.4
	25.4	22.3
	25.5	22.3
	25.4	22.4
	25.3	22.5
	25.2	22.5
	25.1	22.6
	25.2	22.8
	25.1	22.9
	25.0	22.9
	25.0	23.0
	25.0	23.0
	25.0	23.0
	25.0	23.1
	25.1	23.1
	25.0	23.1
	25.1	23.0
	24.9	23.0
	25.0	23.0
	25.0	23.1
	24.9	23.1

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1.3 Print Buffers

Digi 4 stores trend data in two print buffers: the fast print buffer and the slow print buffer. The terms "fast" and "slow" refer to the interval between storage of data points. The chart speed you select determines the interval. Section 1.4 contains the table of chart speeds.

- The fast print buffer stores the most recent samples of data. Every trend data report is automatically stored in the fast print buffer. The interval between data points is either 10 or 20 seconds and depends on the chart speed selected. The time stamp lines show each new minute (10 second interval) or each new even minute (20 second interval). There are 6 data points in each time stamp interval.

- The slow print buffer receives data from the fast buffer at a user-defined interval (from 1 to 24 minutes). The chart speed you select determines when trend data is copied from the fast to the slow print buffer. The time stamp lines reflect a longer time interval, from 5 minutes to 2 hours and depend on the chart speed selected. There are 5 data points in each time stamp interval.

Each print buffer can store 61 samples. A sample contains the date, time and data from 32 channels. After the print buffer is full, the printer deletes the oldest sample when it receives a new trend data report. Section 3.3 explains how to clear the print buffer.

The printer can trend data from the fast or the slow print buffer. A trigger determines which buffer is used. When the trigger is ON, the printer trends data from the fast print buffer. When the trigger is OFF, the printer trends data from the slow print buffer. (Section 1.6 explains how the triggers operate.)

The chart speed, the trigger that selects the fast or slow print buffer and the triggers that clear the print buffer are all defined in the date/time message. (Section 2.3 explains how to enter the date/time message.)

1.4 Chart Speed

The chart speed determines when:

- The trend data report is generated (10 or 20 seconds)
- A copy of trend data is transferred from the fast to the slow print buffer
- A time stamp is printed

The chart speeds range from 00 to 13.

- Chart speed of 00 to 07. Set a system timer to generate the trend data report at 10 second intervals. If the trend data is from the fast buffer, a time stamp is printed every new minute (every 6th sample). If the trend data is from the slow buffer, a time stamp is printed every 5th sample.

- Chart speed of 08 to 13. Set a system timer to generate the trend data report at 20 second intervals*. If the trend data is from the fast buffer, a time stamp is printed every new even minute (every 6th sample). If the trend data is from the slow buffer, a time stamp is printed every 5th sample.

Table 1 lists the chart speeds. It also shows the time interval for the system timer, the time between data samples, when a time stamp is printed, how much data (in units of time) appears on each page and how often samples are copied from the fast to the slow buffer.

* To generate the trend data report every 20 seconds, the seconds entry in the intial reset time must be 00, 20 or 40. (See Section 2.4 in this manual or Section 6.4.3 in the Digi 4 Monitor/Control User's Manual for more information on system timers.)

Table 1. Chart Speeds

Chart Speed	Set Timer	---- FAST BUFFER ---- Time Between Data Samples	Time Stamp	Time/Page	---- SLOW BUFFER ---- Copy Sample From Fast To Slow Buffer	Time Stamp	Time/Page
00					1 minute	5 min.	1 hour
01	1 0	1 0	N E W	1 0	2 minutes	10 min.	2 hours
02					4 minutes	20 min.	4 hours
03	S E C O N D S	S E C O N D S	M I N U T E S	M I N U T E S	6 minutes	30 min.	6 hours
04					8 minutes	40 min.	8 hours
05					12 minutes	60 min.	12 hours
06					16 minutes	80 min.	16 hours
07					24 minutes	120 min.	24 hours
08	2 0	2 0	N E W	2 0	2 minutes	10 min.	2 hours
09					4 minutes	20 min.	4 hours
10	S E C O N D S	S E C O N D S	E V E N M I N	M I N U T E S	8 minutes	40 min.	8 hours
11					12 minutes	60 min.	12 hours
12					16 minutes	80 min.	16 hours
13					24 minutes	120 min.	24 hours

1.5 Trending Modes

Auto-Trend can trend data in two modes: live or historical.

- In the live trending mode, the printer trends data as it is received.
- In the historical trending mode, the printer trends one full page of stored data (or as much as exists).

Live Trending Mode

In the live trending mode, the printer trends data as it receives it as long as the live trigger is ON. (Section 1.6 explains how triggers operate.) You select the chart speed and define a system timer to generate the trend data report at 10 or 20 second intervals. Only one trend at a time can be in the live trending mode. When the trigger goes OFF, the printer stops trending.

You can configure the trend to include historical data before the live trend begins. The character " > " marks the point at which live trending began. For example, if an alarm condition triggers the trend, a fixed amount of historical data, e.g., 5 minutes, can precede the live trend data. This allows you to trace the conditions that led to the alarm.

To include historical data before the live data, simply specify how many time stamp intervals (1-9) of historical data should precede the live data. (This information is stored in the header of the trend data report. See Section 2.3.) The time stamp interval depends on the chart speed selected and the print buffer (fast or slow) generating the trend. A time stamp interval can vary from 1 minute to 2 hours. If the printer trends data from the fast print buffer, there are 6 data points in each time stamp interval. If the printer trends data from the slow print buffer, there are 5 data points in each time stamp interval.

If a live trend continues for more than one page, the system ends each page with the x-axis references, the bottom-of-page title and the date of the last point plotted. Then, it proceeds to the top of the next page, prints the date of the first point plotted on that page, the top-of-page title, the trend summary, the channel identifiers (A-F or A-L), channel labels and units. The trend begins with the data printed in the last time stamp interval on the previous page. This establishes continuity from page to page and makes it easier for you to follow the plot lines. Continuous trend pages are also numbered to simplify collation.

Historical Trends

Historical trends are "one shot" trends. When the historical trigger turns ON, the printer outputs a single page of stored (buffered) data. Historical trends are edge triggered, i.e., the trigger generating an historical trend must go from OFF to ON.

The chart speed you select determines the amount of data (10 minutes to 24 hours) in the historical trend. Full page historical trends can only be triggered if no live triggers are active. (See Section 1.6.) At the end of the historical trend, the system prints the x-axis references, the bottom-of-page title and the date of the last point plotted. Then it issues a form feed.

If the print buffer is full, the historical trend contains 61 data points. When trend data is from the fast print buffer, 11 horizontal lines form 10 grids; there 6 data points per grid. When trend data is from the slow print buffer, 13 horizontal lines form 12 grids, there are 5 data points per grid. If the print buffer contains less than a full page of data, the trend starts with the horizontal grid that contains the first data point. Time stamps accompany the horizontal lines that follow and are normalized per the selected chart speed.

No more than 7 historical trends (the first 7 that the printer receives) can be generated from one trend data report. This assumes that the trend data report is generated every 20 seconds. If the trend data report is generated every 10 seconds, configure the trends so that no more than 3 historical triggers turn ON in a single trend data report.

We impose these limits because the printer cannot accept new trend data reports while it is busy printing historical trends. The system stores new trend data reports in its text output buffer until the printer finishes printing all historical trends. The text output buffer is a temporary storage location and can hold a fixed amount of data. To avoid a buffer overflow and a potential loss of data, you should calculate the maximum number of bytes that will be stored in the text output buffer. (Section 3.3 of this manual and Section 9.3 of the Digi 4 Monitor/Control User's Manual explain how to calculate the number of bytes in the text output buffer.)

Figure 6 shows a sample of a live trend and an historical trend. The chart speed for both trends is 00. A chart speed of 00 requires that you set a system timer with a 10 second time interval. When the timer resets, the trend data report is generated and stored in the fast print buffer.

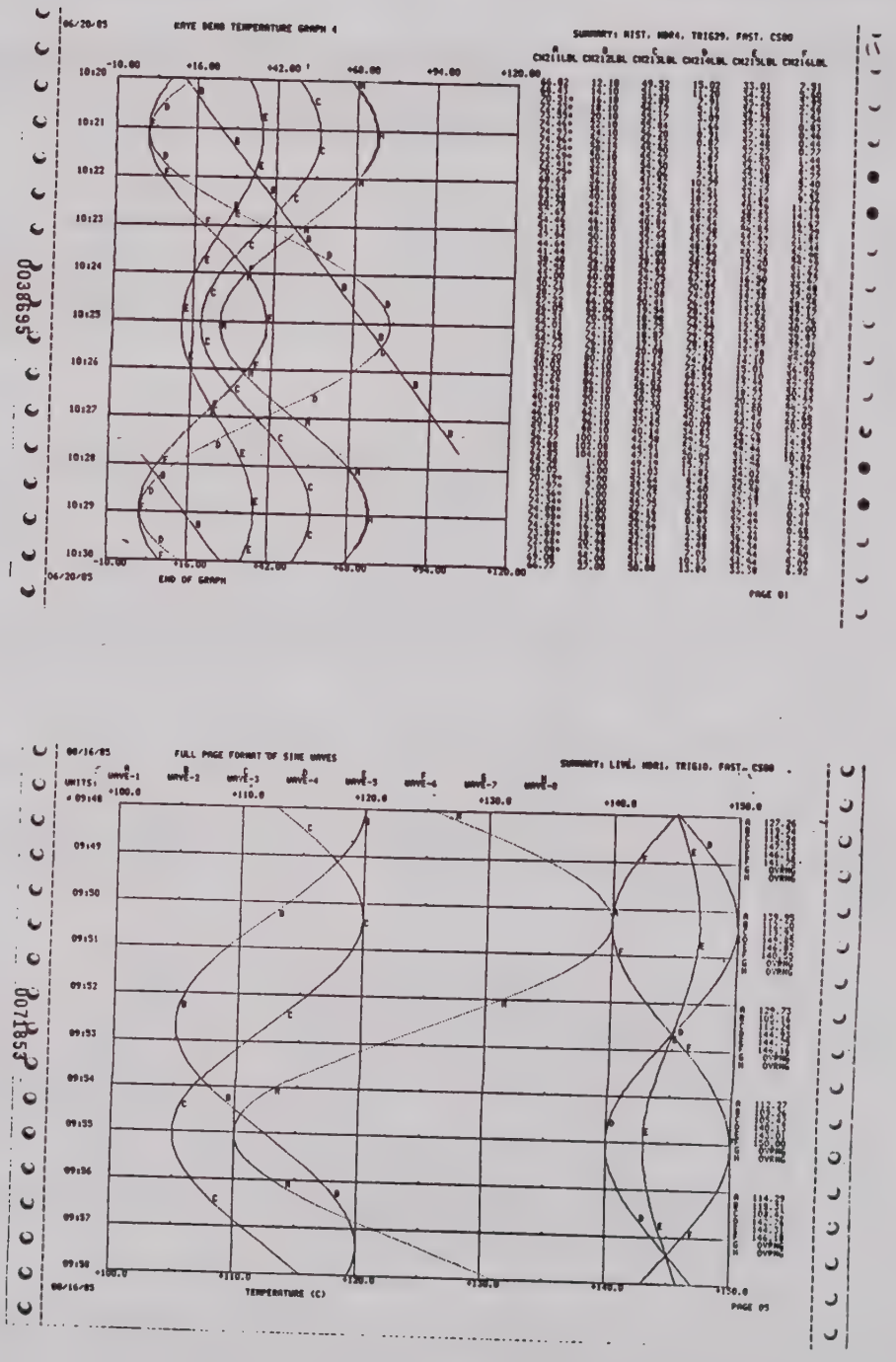

KAYE DEMO TEMPERATURE GRAPH 4
SUMMARY: HIST. HR04. TRIG29. FAST. CS00
END OF GRAPH
PAGE 01
FULL PAGE FORMAT OF SINE WAVES
SUMMARY: LIVE. HR01. TRIG10. FAST. CS00
TEMPERATURE (C)
PAGE 05

Figure 6. Samples of Live and Historical Trends

Abbreviating Trends

Auto-Trend prints a live trend until its trigger turns OFF, a higher priority live trigger turns ON, the printer software detects an error or format change in the trend data report or receives another type of Digi document; e.g., a message or a standard data report. You can direct the printer to abbreviate the trend if one of these conditions occurs.

Historical trends are single page trends. The printer trends 61 data points from the print buffer. If the printer begins a trend and then runs out of data; i.e., the buffer does not contain 61 samples, the trend can be abbreviated with the horizontal grid that contains the last point.

When the printer abbreviates a trend, it prints the x-axis references, the bottom-of-page title, and the date of the last point plotted and then executes a form feed. If you do not direct the printer to abbreviate the trend, it fills out the page with blank horizontal grids. No time stamps are printed for blank horizontal grids. (The direction to abbreviate the trend is specified in the date/time message. See Section 3.3.)

Figure 7 shows two trends. One trend has the abbreviate trend function enabled; the other has it disabled.

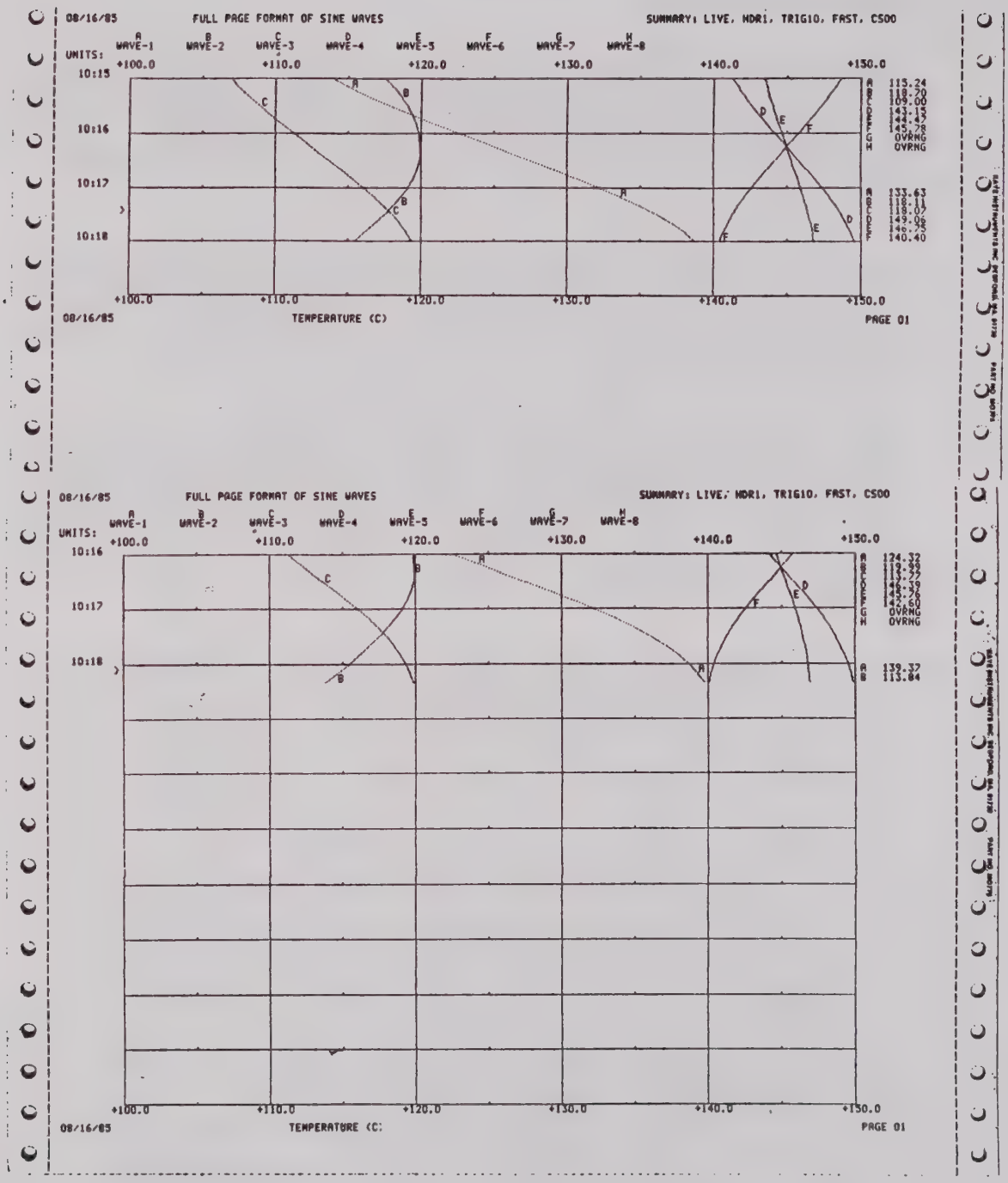


Figure 7. Abbreviated Trend vs. Non Abbreviated Trend

1.6 Triggers

Triggers control trending! They initiate the trend, select live or historical trending, select the data from the fast or slow buffer and clear the print buffers. Think of a trigger as a flag; it signals the printer to stop or go! A trigger can be a Digi 4 Relay (01-48), Status Input (51-82) or you can select two special triggers, 00 and 99. Trigger 00 is always ON and trigger 99 is always OFF. Trigger 00 is the highest priority trigger, followed by Relays 01-48, Status Inputs 51-82 and trigger 99.

> Note:
> The ON/OFF states of the relays and status inputs must be included in the trend data report. Otherwise, the printer does not know if a trigger is ON or OFF, and an error occurs. (See Section 2.2, Configuration Code Address 016, 026, 036, and 046.)

The triggers must stay set for at least the time interval of the trend data report (10 or 20 seconds). Otherwise, the printer may not detect the ON or OFF transition.

Relay triggers are usually turned ON when a limit is exceeded or when a series of user-specified conditions are satisfied. They normally remain ON for at least 10 or 20 seconds. However, to guarantee that the relay trigger remains ON for the time interval of the trend data report, you can program a flip-flop function to latch the relay trigger ON. (For more information on the flip-flop functions, refer to Section 5.18 of the Digi 4 Monitor/Control Manual.)

Status input triggers are turned ON by external switches. To guarantee that the status input trigger remains ON for the time interval of the trend data report, use a toggle, not a momentary switch. If you must use a momentary switch, you can program a flip-flop function to latch the status input trigger ON.

Triggers Select Live or Historical Trends

The printer can trend data as it receives it (live mode) or store it and trend it at a later time (historical mode). You can define a live trigger and an historical trigger for each trend. You specify the live and historical trigger in the header. The live trigger must be ON to generate a live trend. The historical trigger must go from OFF to ON to generate an historical trend. Live triggers have priority over historical triggers. (Section 1.5 describes the live and historical trends.)

Triggers can be turned ON by an event, such as a limit exceeded, by an operator or at a user-specified time interval. You can configure the system to trigger trends at different time intervals or by different events. The system can generate an hourly trend that shows what happened at one minute intervals during that hour, start a trend when an operator presses a button, automatically trend performance data after starting a batch operation or generate multiple trends when an alarm condition occurs.

Note:
No more than 7 historical triggers should turn ON in one trend data report. (See Section 1.5 Historical Trends.)

Triggers Select the Fast or Slow Print Buffer

The printer can trend data from the fast or slow print buffer. The state of a trigger, ON or OFF, determines which print buffer is used. You specify the trigger for the print buffer in the date/time message. When the trigger is OFF, the system trends data from the slow print buffer. When the trigger is ON, the system trends data from the fast print buffer. For example, if you select Relay 05 as the trigger for the print buffer, the printer can trend data from the slow buffer during normal operating conditions. But, if an alarm occurs, the system can turn ON Relay 05 and begin trending data from the fast buffer.

If you select 00 as the trigger for print buffer, the printer will always trend data from the fast print buffer. (Trigger 00 is always ON.) If you specify 99 as the trigger for print buffer, the printer will always trend data from the slow print buffer. (Trigger 99 is always OFF.)

Triggers Clear the Print Buffer

There are triggers to clear the print buffers. If you no longer need the data in the print buffers, or change a parameter and want to begin trending with new data, you can specify a clear buffer trigger. One trigger clears the print buffer before trending and the other clears the print buffer after trending. When the trigger turns ON, all trend data is deleted from the print buffer. You specify the clear buffer triggers in the date/time message. (See Section 2.3 for more information on the date/time message.)

The system also clears the print buffer when you perform a print test or at power up if you set the DIP switch on the Print Control board to initialize the print buffer. (See Section 2.3 for more information about clearing the print buffer.)

1.7 Basic Operation

You select the trend data report, configure it according to the directions in Section 2.2 and 2.3 and set a system timer to generate it every 10 or 20 seconds.

Trend data reports pass through the text output buffer and then are sent to the printer. The printer software compares each new trend data report to the previous one. It makes this comparison for two reasons:

1. To check for changes or errors in the format or contents of the trend data report
2. To determine if a trigger is requesting a trend

If the printer detects a change, it stops trending, ends the current trend and prints the contents of the trend data report followed by a graphic report message. If the new trend data report contains an error (format, length or syntax), an error message appears. (See Section 4 for more information on format, length and syntax errors.) If the new trend data report does not contain an error, the message GRAPHIC REPORT FORMAT CHANGE appears and the system checks the triggers.

The printer checks the live triggers first. Live triggers have a higher priority than historical triggers. If more than one live trigger is active, the system initiates the trend with the highest priority trigger. Trigger 00 has the highest priority, followed by Relays 01-48 and Status Inputs 51-82. If more than one trend has the same live trigger (and it is ON), the printer initiates the trend defined by the header with the highest priority. Header 1 has the highest priority.

The printer continues trending until the live trigger turns OFF, a higher priority live trigger turns ON, the printer detects an error or format change in the trend data report or receives another type of Digi document; e.g., a message or standard data report. When you set up the trend data report, you can direct the printer to abbreviate the trend when any one of these conditions occurs. If you do not select the abbreviate trend option, the printer stops plotting the data points and fills the remainder of the page with blank grids.

If no live triggers are ON, the printer compares the historical triggers in the most recent trend data report with those of the previous trend data report. It begins with header 1 and checks to see if its historical trigger has turned ON since the last trend data report.

Note:
The printer does not check the previous state of an historical trigger after a format change.

If more than one historical trigger turns ON in the same trend data report, the printer begins printing the trend defined by the header with the highest priority. Header 1 has the highest priority, header 9 the lowest. Each historical trend appears on a new page.

Only 7 historical trends (the first 7 that the printer receives) can be produced from one trend data report. If more than 7 historical triggers turn ON in the same trend data report, the system ignores the triggers in headers 8 and 9. This assumes that the trend data report is generated every 20 seconds. If the trend data report is generated every 10 seconds, no more than 3 historical trends should be generated in the same trend data report. (Section 3.2 explains how to determine the maximum number of trend data reports that the text output buffer can hold and what happens if that number is reached.)

SECTION 2 - SETTING UP THE TREND DATA REPORT

Digi 4 uses one of its standard general-purpose data reports to send trend data and formatting/control information to the printer. The trend data report follows a fixed format and is defined by a group of configuration codes and text messages.

To set up the trend data report,

- Select the data report to be used as the trend data report
- Specify the configuration codes for that report
- Define the format, triggers and contents of each trend
- Set a system timer with a 10 (or 20) second reset time

This section of the Auto-Trend Manual explains how to set up the configuration codes and text messages that format and trigger the trends. There is an example for each configuration code and text message.

2.1 Selecting the Trend Data Report

You can select any one of the standard data reports as the trend data report. Digi 4 has four standard data reports: Data Reports 1, 2, 3, and 4. If your system includes Kaye's Workstation, Data Report 1 is reserved for the Workstation.

2.2 Setting Configuration Codes

The key to setting up reports, both standard and trend, is the configuration codes. The Digi 4 report you select as the trend data report determines which configuration code addresses you use. The chart below shows the configuration code addresses that format and control the individual reports.

If you select:	Use configuration code addresses:
Data Report 1	010, 011, 012, 013, 014, 015 and 016
Data Report 2	020, 021, 022, 023, 024, 025 and 026
Data Report 3	030, 031, 032, 033, 034, 035 and 036
Data Report 4	040, 041, 042, 043, 044, 045 and 046

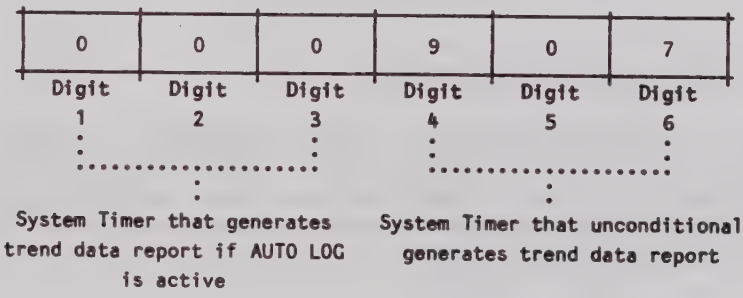
Configuration Code Address 010 (020, 030, 040)

Configuration Code Address 010 (020, 030, 040) stores the logic address of a system timer. Set a system timer with a 10 (or 20 second) time interval. This interval is determined by the chart speed selected. When the system timer resets, the trend data report is generated. (Section 2.4 explains how to set a system timer.)

Digi 4 has 16 system timers (01-16). You can use any one of these timers to generate the trend data report. System timers 01-16 correspond to logic addresses 901-916. For example, if you set a 10 second interval at system timer 07, assign logic address 907 to Configuration Code Address 010 (020, 030, 040).

You can assign the timer logic address to either digits 1-3 or digits 4-6. If you assign the address to digits 1-3, the AUTO LOG must be ON when the timer resets to generate the trend data report. You can stop generating trend data reports by disabling the AUTO LOG. If you assign the timer address to digits 4-6, the system automatically generates a trend data report whenever the system timer resets.

In the illustration below, digits 4 to 6 contain the logic address 907. This means that whenever timer 07 resets, the system generates a trend data report.



Configuration Code Address 011 (021, 031, 041)

Configuration Code Address 011 (021, 031, 041) is not used with trending. The default value is 000000.

Configuration Code Address 012 (022, 032, 042)

Configuration Code Address 012 (022, 032, 042) specifies how many trend data reports can be stored in the text output buffer and what happens if this number is reached. It also specifies the output port (Printer and/or Communication Port) for the trend data report.

Digits 1 and 2 specify the maximum number of trend data reports to be stored in the text output buffer. Your options include 00-29. If your system is used exclusively for trending, set the maximum at 29. If the Text Output Buffer holds other Digi reports and/or messages, select a lower number. For more information about the Text Output Buffer, see Section 3.2 of this manual and Section 9.3 in the Digi 4 Monitor/Control System User's Manual.

Digit 3 enables/disables the delete oldest function. Enter 0 or 1.

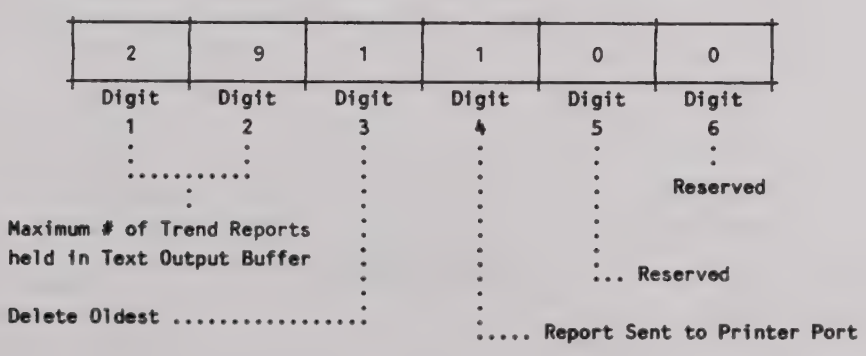
0 = Delete newest trend data report when maximum in buffer
1 = Delete oldest trend data report when maximum in buffer

Digit 4 directs the trend data report to the printer port. Assign a 1 to digit 4.

Digit 5 is not used with trending. Default value is 0.

Digit 6 is not used. Default value is 0.

In the illustration below, the text output buffer will hold a maximum of 29 trend data reports and delete the oldest if more than 29 are in the buffer at one time. The trend data reports are sent to the printer port.



Configuration Code Address 013 (023, 033, 043)

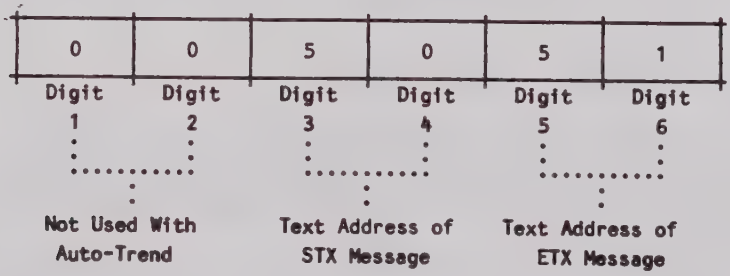
Configuration Code Address 013 (023, 033, 043) specifies the text addresses of the Start-of-Text (STX) and the End-of-Text (ETX) messages. The STX message, a command code automatically transmitted as part of the first line of the trend data, signals the printer that the report contains trend data. The ETX message, a command code automatically transmitted as the final line, defines the end of the trend data report. Section 2.3 explains how to enter the STX control characters in the text address you select here. Digi 4 text addresses are 01-99.

Digits 1 and 2 are not used with trending. Enter 00.

Digits 3 and 4 specify the address of the STX message.

Digits 5 and 6 specify the address of the ETX message.

In the illustration below, the STX message is stored at text address 50 and the ETX message is stored at text address 51. Section 2.3 explains how to enter the STX and ETX control characters at text addresses 050 and 051.



Configuration Code Address 014 (024, 034, 044)

Configuration Code Address 014 (024, 034, 044) formats the header(s), specifies the address of the first header message and identifies the number of headers in the trend data report.

Digit 1 is not used with trending. Assign a value of 0.

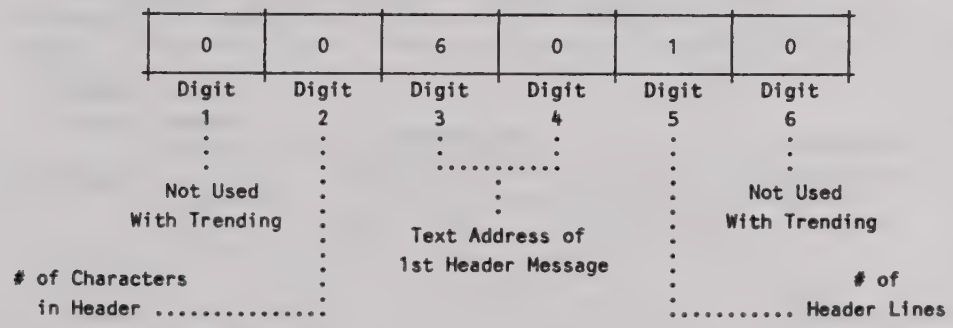
Digit 2 specifies the number of characters in the header. A trend data report must have 128 characters in the header. Set digit 2 equal to 0 for a 128 character header. Each character, or group of characters, in the header has a purpose. See Section 2.3 for a description of each character.

Digit 3 and 4 specify the address (01-99) of the first header message. Each header line uses four consecutive text addresses to define one trend. You can specify up to 9 header lines (36 consecutive text addresses).

Digit 5 specifies the number of header lines (1-9) in the trend data report. Each header line contains 4 text messages and defines one trend. You can define up to 9 trends using the 9 header lines.

Digit 6 is not used with trending. Assign a value of 0.

In the illustration below, we specified one header line with 60 as the address of the first header message. This means that text addresses 060-063 format the trend. Section 2.3 explains how to enter the trend control and format information into the header messages.



Configuration Code Address 015 (025, 035, 045)

Configuration Code Address 015 (025, 035, 045) formats the body of the trend data report and specifies the address of the date/time message.

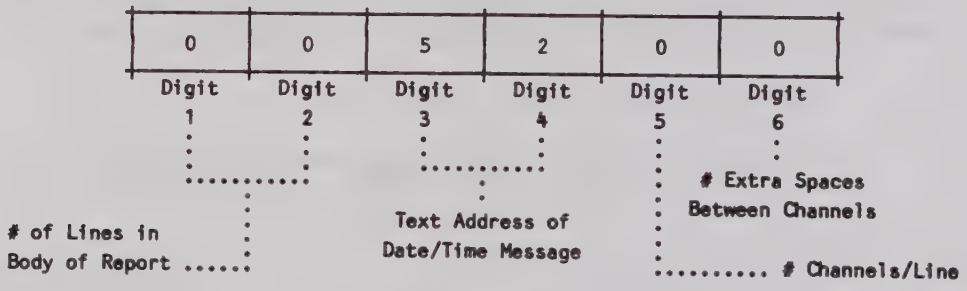
Digits 1 and 2 specify the number of lines in the body of the trend data report. Assign 0 to digits 1 and 2. Auto-Trend controls the number of lines.

Digits 3 and 4 specify the address (01-99) of the date/time message. The date/time message contains trend control information. Each character in the date/time message has a purpose. See Section 2.3 for a description of the parameters that make up the date/time message.

Digit 5 specifies how many channels to format per line. Trending requires a 16 channel per line format. Assign a 0 to digit 5 to select the 16 channel per line format.

Digit 6 formats extra spaces between channels. The trend data report adheres to a fixed format and does not allow extra spaces between channels. Assign 0 to digit 6.

In the illustration below, the address of the date/time message is 52. Section 2.3 explains how to enter the trend control information into the date/time message.



Configuration Code Address 016 (026, 036, 046)

Configuration Code Address 016 (026, 036, 046) formats channel labels, includes the states (ON/OFF) of relays and status inputs in the trend data report and specifies the 2 rows of channel data to be used for trending.

Digit 1 formats the channel labels. Trending requires the labels above channel data. Assign 3 to digit 1.

Digit 2 includes the states (ON/OFF) of Relays 01-48 and Status Inputs 51-82 in the trend data report. Trending requires this information to update the triggers. Assign 1 to digit 2.

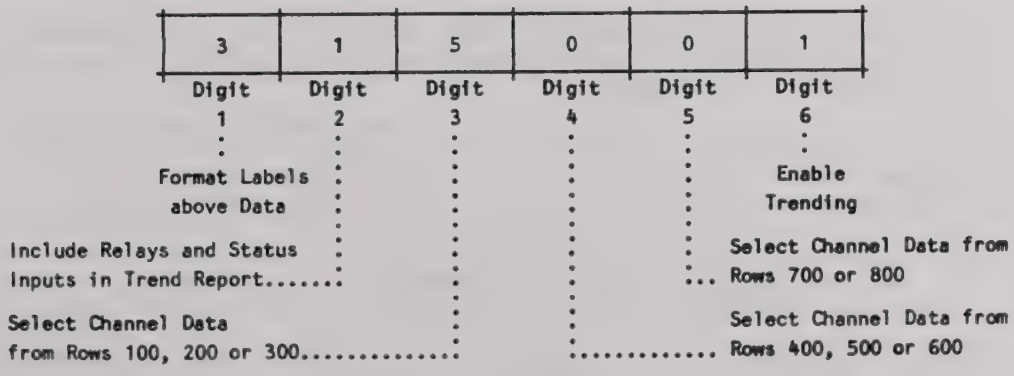
Digits 3, 4 and 5 specify the two rows of channels that supply trend data. The trend data report must contain two rows; the rows do not have to be consecutive. Use the information below to determine the value of the digits.

Digit 3		Digit 4		Digit 5	
100	+1	400	+1	700	+1
200	+2	500	+2	800	+2
300	+4	600	+4		

Each row has a value (+1, +2 or +4). Select the 2 rows to be included in the trend data report and assign the number next to the row to the digit. If one digit specifies more than one row, total the numbers and assign the total to the digit. For example, to include data from rows 100 and 300, assign 5 to digit 3. Assign 0 to those digits that contain rows not included in the trend data report.

Digit 6 enables trending. ALWAYS assign a 1 to digit 6.

In the illustration below, we formatted the labels above the data, included the relay and status input information in the trend data report, selected trend data from rows 100 and 300 and enabled trending.



2.3 Entering Text Messages

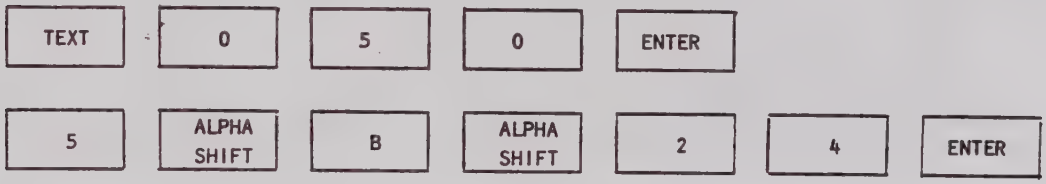
The trend data report contains several text messages that specify the format, triggers and contents of each trend. These text messages are:

- The Start-of-Text message (STX)
- The End-of-Text message (ETX)
- The Report Headers
- The Date/Time message

STX Message

The STX message precedes the trend data report and must contain a left bracket "[" and a dollar sign "$". You can enter the STX message at any text address 01-99. When you enter the STX message, key in 5B24. This is the hexadecimal equivalent of "[" and "$".

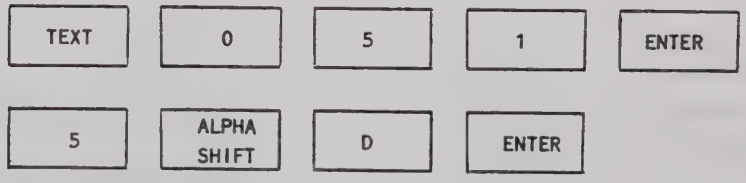
In Section 2.2 (Configuration Code Address 013), we selected 50 as the text address of the STX message. To enter 5B24 at text address 50, key in the following:



The ETX Message

The ETX message follows the trend data report and must contain a right bracket "]". You can enter the ETX Message at any text address 01-99. When you enter the ETX message, key in 5D. This is the hexadecimal equivalent of "]".

In Section 2.2 (Configuration Code Address 013), we selected 51 as the text address of the ETX message. To enter 5D at text address 51, key in the following:



Header Messages

A trend data report can have 9 header lines. Each header line defines one trend and consists of 4 consecutive text messages. Each text address has 32 characters. You specify the address of the first header message and the number of header lines. This is how the system knows which text addresses to use for trending.

For example, in Section 2.2 (Configuration Code 014), we specified 60 as the text address of the first header message and selected 2 header lines. Text addresses 060-063 will supply the format, triggers, contents and titles for the first trend and text addresses 064 to 067 the format, triggers, contents and titles for the second trend. You must enter the required trend information at these text addresses.

The characters in the header follow a fixed format. The first two messages in the header supply format and control information. The last two messages define the trend titles.

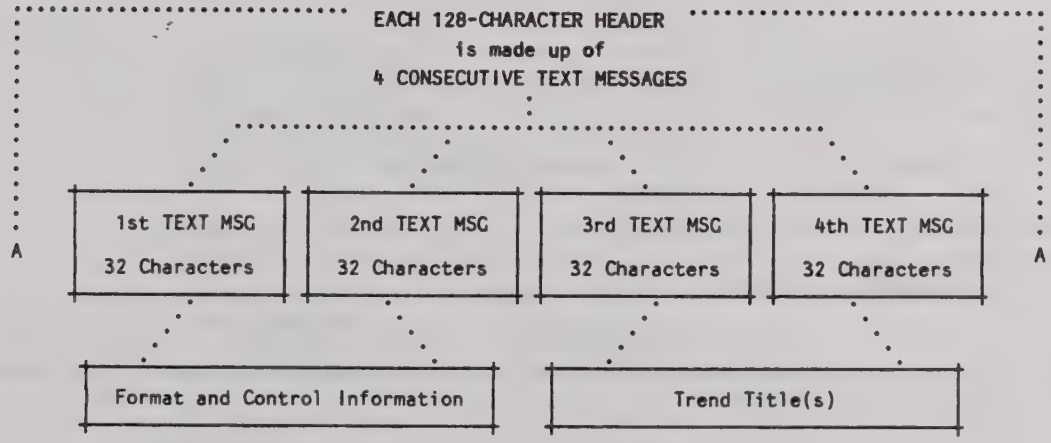


Figure 8. Header Messages

1st and 2nd Header Messages

The 1st and 2nd header messages contain 64 characters and define 19 parameters. These parameters specify the format and control for trending. Always separate one parameter from the next with a slash (/) and enter 0/ (or 00/) if you are not using a parameter. Press the ENTER Key at the end of the 1st message and then again at the end of the 2nd message. If you define all parameters, the total number of characters will equal 63. The 19 parameters in the 1st and 2nd text messages are:

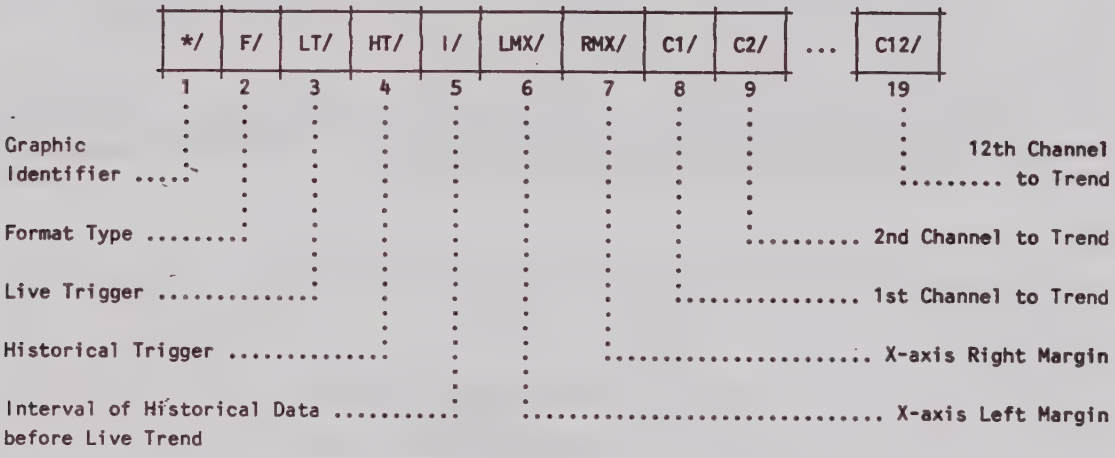

*/ F/ LT/ HT/ I/ LMX/ RMX/ C1/ C2/ ... C12/
1 2 3 4 5 6 7 8 9 19
Graphic Identifier
Format Type
Live Trigger
Historical Trigger
Interval of Historical Data before Live Trend
12th Channel to Trend
2nd Channel to Trend
1st Channel to Trend
X-axis Right Margin
X-axis Left Margin

Figure 9. 1st and 2nd Header Messages

Parameter	Purpose
1	Acts as Graph Identifier. A asterisk (*) begins each header line in a trend data report. Enter an (*) and separate this parameter from the next with a slash (/).
2	Selects Trending Format. Enter a 1, 2 or 3 and separate this parameter from the next with a slash (/). 1 = 6-point format, 2 = 12-point format, 3 = digital format
3	Identifies Live Trigger. When the live trigger is ON, the system trends data as soon as the printer receives it. Live triggers have priority over historical triggers. The live trigger can be: 00 = Always ON, 01-48 = Relays, 51-82 = Status Inputs (A trigger of 99 disables live trending.) Enter 2-digits and separate this parameter from the next with a slash (/).

Parameter	Purpose
4	Identifies Historical Trigger. When the historical trigger turns ON (no live triggers ON), the system trends one full page of stored data. The trigger can be one of the following: 01-48 = Relays, 51-82 = Status Inputs (A trigger of 00 or 99 disables historical trending.) Enter 2 digits and separate this parameter from the next with a slash (/).
5	Specifies how much, if any, historical data precedes a live trend. Your options include 0-9 and select the number of time stamp intervals. For example, if you select 2, the printer trends 2 time stamp intervals of historical data before a live trend. Enter a value from 0 to 9 and separate this parameter from the next with a slash (/).
6 & 7	Define the Left and Right X-axis Margins. Parameter 6 defines the left margin and parameter 7 defines the right. You enter values for both margins, and the system extrapolates the values of the four intermediate vertical lines. An error occurs if the value of the left margin is equal to or greater than the value of the right margin. If you change the value of the left or right margin, the system stops the trend, issues a Format Change Mesage and begins trending again with the new values. Enter values (maximum of 5 digits, sign and decimal) for the left margin and and right margins. Separate the parameters with a slash (/).
8 - 19	Specify which Channels (relative channel addresses) are trended. Digits 3, 4 and 5 of Configuration Code Address 016 (026, 036, 046) specify the two rows of channels that supply the trend data. The 16 channels in the first row are relative channel addresses 01-16; the 16 channels in the second row are relative channel addresses 17-32. For example, in Section 2.2 (Configuration Code Address 016) we selected rows 100 and 300 to supply the trend data. The chart below shows the relationship between the 2 rows of channels in the trend data report and the relative channel addresses. Channel Addr 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 Relative Ch Addr 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 Channel Addr 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 Relative Ch Addr 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 The 6-point format lets you enter 6 relative channel addresses in parameters 8-13. The 12-point and digital formats let you enter 12 relative channel addresses in Parameters 8-19. Enter the relative channel address 01-32 or, 00 if a parameter(s) is not used, and separate the parameters with a slash (/).

In Section 2.2 (Configuration Code 014) we selected 60 as the first header message. In the example below, we use text address 060 to 063 to define the 1st header line and specify the format, triggers and contents of the first trend.

The 1st and 2nd header messages (060 and 061) specify the graphic identifier, the format, the live trigger, the historical trigger, the values of the left and right margins and the relative channel addresses of the data included in the trend. In our example, the 1st and 2nd header messages contain the following data: */1/02/05/1/0.0/100.0/01/02/03/04/05

*	= Graphic Identifier
1	= Format (6-point format)
02	= Live trigger (Relay 02)
05	= Historical trigger (Relay 05)
1	= Amount of historical data (1 time stamp interval) to precede live trend
0.0	= Value of left margin
100.0	= Value of right margin
01/02/03/04/05	= Relative Channel Addresses (Data in our trend data report is from channel in rows 100 and 300. These relative channel addresses correspond to Channels 101-105.)

This information requires 34 characters. Enter the first 32 characters (*/1/02/05/1/0.0/100.0/01/02/03/0) in text address 060 and the last 3 characters (4/05) in text address 061. Make sure to press the ENTER key after you key in the message at text address 060 and then again after you key in the remainder of the message at text address 061.

3rd and 4th Header Messages

The 3rd and 4th header messages define titles for the trend.

- If your top-of-page title is 32 characters or less, enter the text in the 3rd header message and press the ENTER key. Leave the 4th text message blank.

- If your top-of-page title is more than 32 characters use both the 3rd and 4th text messages to define the title. Press the ENTER key at the end of the 3rd header message and then again at the end of the 4th. The example below shows 32 characters in the 3rd header message and 19 characters in 4th header message.

  3rd message: GRAPH 1 SHOWS CRITICAL TURBINE B (Press ENTER)
  4th message: EARING TEMPERATURES (Press ENTER)

- To define a top-of-page and a bottom-of-page title use both the 3rd and 4th header messages. The 3rd message is printed at the top of the trend and the 4th is printed at the bottom of the trend. To signal the printer that the 4th message is a bottom-of-page title, begin it with a period (.). Otherwise, the system prints the both messages as a top-of-page title. The example below uses the 3rd header message to define the top-of-page title and the 4th header message to define the bottom-of-page title.

  3rd message: GRAPH 1 - TURBINE BEARING TEMPS (Press ENTER)
  4th message: . END OF BEARING TEMP GRAPH (Press ENTER)

In Section 2.2 (Configuration Code 014) we selected 60 as the first header message. This means that the 3rd and 4th messages in the header line are stored at text addresses 062 and 063.

At text address 062, key in:

GRAPH 1 - TURBINE BEARING TEMPS

and press the ENTER key. (This message will appear at the top of the trend.)

At text address 063, key in:

.END OF BEARING TEMP GRAPH

and press the ENTER key. (This message will appear at the bottom of the trend.)

Date/Time Message

The date/time message must be included in the trend data report. It contains five parameters that control the system's main trending functions. These parameters include the chart speed (controls the interval for copying trend data from the fast to the slow buffer and the printing of time stamps), the trigger that selects the print buffer (fast or slow), the triggers that clear the print buffers and the directions to abbreviate the trend.

Separate each parameter from the next with a slash (/). Press the ENTER key at the end of the date/time message.

The date/time message parameters are:

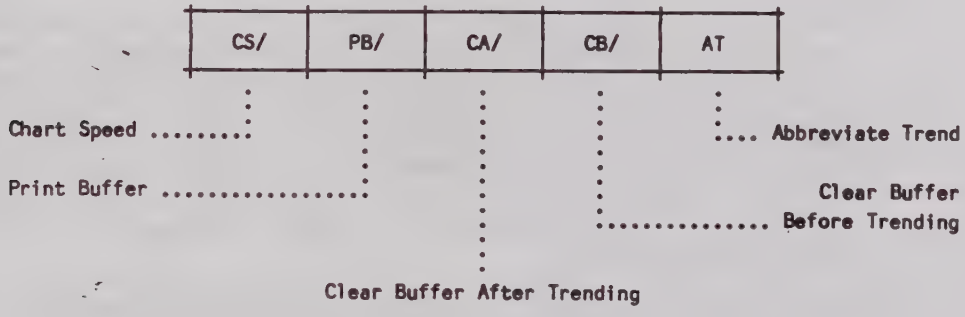


Figure 10. Date/Time Message

Parameter	Purpose
1	Selects Chart Speed. The chart speed determines how often (10 or 20 seconds) the trend data report should be generated and the interval for copying trend data from the fast to the slow buffer. Your options include 0-13. Refer to Table 1 in Section 1.4 for a listing of the chart speeds. Key in a 2-digit value (00 to 13) and separate this parameter from the next with a slash (/).
2	Identifies the Trigger for the print buffer. If the trigger is OFF, the system trends data from the slow print buffer. If the trigger is ON, the printer trends data from the fast print buffer. Your options include Relays 01-48, Status Inputs 51-82 or two special triggers: 00 (always ON) or 99 (always OFF). Key in a 2-digit trigger and separate this parameter from the next with a slash (/).

Parameter	Purpose
3	Identifies the Clear After trigger. When the Clear After trigger turns ON, the system clears the print buffer after it trends the data in the current trend data report. The trigger can be a Relay (01-48) or a Status Input (51-82). Use trigger 99 if you do not want to clear the print buffer. Key in a 2-digit trigger and separate this parameter from the next with a slash (/).
4	Identifies the Clear Before trigger. When the Clear Before trigger turns ON, the system clears the print buffer before storing new trend data. The trigger can be a Relay (01-48) or a Status Input (51-82). Use trigger 99 if you do not want to clear the print buffer. Key in a 2-digit trigger and separate this parameter from the next with a slash (/).
5	Enables or disables the Abbreviate Trend option. If the printer detects a format error, a format change, a change in trigger or another type of Digi document; i.e., a data report or an alarm message, it stops trending. Parameter 5 lets you decide how to format the remainder of the page. Your options include 0 or 1. 0 = Fill out the page with blank grids 1 = Abbreviate the trend Key in a value of 0 or 1 and press the ENTER key.

In Section 2.2 (Configuration Code Addresses 015, 025, 035, 045), we specified 52 as the text address of the date/time message. Now key in 00/08/99/99/1 at text address 052 and press the ENTER key.

00 = Chart speed
08 = Trigger for print buffer (Relay 08)
99 = Clear buffer after trend trigger (99 = Do not clear)
99 = Clear buffer before trend trigger (99 = Do not clear)
1 = Abbreviate trend

2.4 Setting the System Timer

Set a system timer with a 10 second interval for charts speeds of 0 to 7. Set a system timer with a 20 second interval for charts speeds of 8 to 13. (For more information about system timers, see Section 6.4.3 of the Digi 4 Monitor/Control User's Manual.)

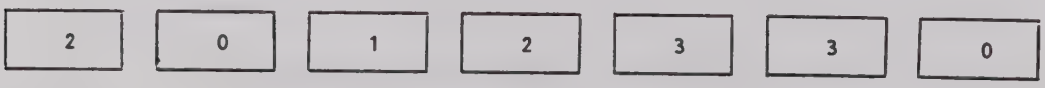
To set a system timer:

- Select any one of the system timers 01-16
- Enter a 10 or 20 second time interval and the initial reset time (If a 20 second timer is used, the seconds entry in the initial reset time must be 00, 20 or 40.)
- Assign the timer's logic address (901-916) to the configuration code (010, 020, 030 or 040) generating the trend data report

The illustration below shows the keystrokes required to set a 10 second interval at system timer 07. The logic address of the timer 07 is 907. Assign logic address 907 to the configuration code address (010, 020, 300 or 040) generating the trend data report.

Enter a 10 second time interval at system timer 07.

Enter a reset time a few minutes ahead of the current time. (We used 12:33 PM on the 20th day of the month.)



SECTION 3 - PRINTING

This section describes how to set the printer's baud rate and DIP switch. It also describes the text output buffer and how to clear the print buffers.

3.1 The Printer

The Digistrip 4's printer prints one line of data per second. It has a 5 x 8 dot matrix printhead and uses pressure sensitive paper with the ink already in it. No more messy ribbons or ink spills! There is also an optical paper-out detector that triggers the backup memory. When you reload the paper, the system continues printing where it left off.

The print control board has its own CMOS battery and a buffer for storing data. This permits smooth error-free printing. If there is a power outage, the printer can hold 3000 characters in its memory. If power is lost while the printer is printing a line, the incomplete line is reprinted in its entirety when power is restored.

To use the Auto-Trend option with the Digistrip 4 printer, your system must have the Print Control with Trending Board (U0909) installed. You also have to configure the printer port for 2400 baud and set the DIP switch on the Print Control with Trending board. (The DIP switch settings are explained on the next page.)

Baud Rate

The Digistrip 4's internal printer operates at 2400 baud. Configure the printer port to tramsmit data at 2400 baud.

- Set digit 3 of Configuration Code Address 004 equal to 0
- Set slides 7 and 8 ON (See DIP switch on next page.)

Dip Switch Settings

The DIP switch settings on the Print Control with Trending board specify the baud rate and parity of the printer. They also specify whether vertical lines or the full character set are printed in the test mode and if the print buffers are initialized at power-up. Kaye recommends that you set slides 3, 4, 7 and 8 ON.

Figure 11. Dip Switch Settings On The Print Control With Trending Board

To check the side settings on the Print Control with Trending board, open the front door and slide the chassis forward. The Print Control with Trending board is on the right side of the chassis. Remove the cover plate to access the DIP switch. If the DIP switch slides do not match those in Figure 11, read below and set the slides accordingly. The Digistrip 4 reads a DIP switch on the OFF-to-ON power transition. Set the DIP switch with the power OFF and then power up.

Slide 1 controls the initialization (clearing) of the print buffers at power-up. Set Slide 1 OFF for normal operation.

Slide 1	Action
ON	Initialize (clear) print buffers at powerup
OFF	Do not initialize (clear) print buffers at powerup

Note:

Test mode automatically initializes the trending buffers regardless of the slide 1 setting. See Appendix A for information about test mode operations.

Slide 2 determines what is printed in the test mode.

Slide 2	Action
ON	Vertical lines printed in test mode
OFF	Full character set printed in test mode

Slide 3 selects parity. The Digi printer requires even parity. Set Slide 3 ON.

Slide 3	Action
ON	Even parity
OFF	Odd parity

Slide 4 enables the even parity specified by Slide 3. Set Slide 4 ON.

Slide 4	Action
ON	Enables parity specified by Slide 3
OFF	Disables parity

Slides 5 and 6 are not used with trending. Set Slides 5 and 6 OFF.

Slides 7 and 8 select the baud rate. The Digistrip's built-in printer operates at 2400 baud. Set Slides 7 and 8 ON.

Slide 7	Slide 8	Action
ON	ON	2400 baud
ON	OFF	1200 baud
OFF	ON	600 baud
OFF	OFF	300 baud

Slides 9 and 10 are not used with trending. Set Slides 9 and 10 OFF.

3.2 Text Output Buffer

The Digi 4 generates a trend data report every 10 or 20 seconds depending upon the chart speed you select (See Table 1.) and the system timer you define.

When a report is generated, it enters the text output buffer. The text output buffer is a temporary storage location. Usually reports pass directly from the text output buffer to the print control board. However, if the printer is busy or off line, the text output buffer holds the trend data reports until the printer can accept them. The text output buffer can store 4093 bytes of information. Each trend data report requires 140 bytes of memory.

Overhead per report	34 bytes
2 rows of 16 channels	96 bytes
relay and status	10 bytes
	---------
	140 bytes per report

The text output buffer can hold a maximum of 29 trend data reports (140 bytes x 29 = 4060 bytes). This assumes that there are no other Digi documents; e.g., messages or data reports, passing through the text output buffer. If other Digi documents are also sharing the text output buffer, specify a number less than 29. (See Section 9.3 of the Digi 4 User's Manual for more information on the text output buffer.)

While the printer is busy printing historical trends, it cannot accept any new trend data reports. The text output buffer can hold a maximum of 29 trend data reports. To prevent a buffer overflow and a loss of data, no more than 7 historical trends* can be triggered from one trend data report. We impose this limit because:

- Each trend data report contains 72 lines. 7 trends x 72 lines equals 504 lines.
- The printer outputs 1 line per second. It will take 504 seconds or approximately 9 minutes to print 7 historical trends.
- In the 9 minutes, 27 trend data reports (20 second time interval) will be generated and held in the text output buffer. The text output buffer can store a maximum of 29 trend data reports.

*If reports are generated every 10 seconds, no more than 3 historical trends should be triggered from one trend data report.

3.3 Clear Print Buffers

To clear the print buffer, specify a trigger in parameter 3 or 4 of the date/time message. When the trigger turns ON, the system clears the print buffer. (See page 2-14 for an explantion of the clear buffer triggers.) You can also set the DIP switch on the Print Control with Trending board to initialize the print buffer at power up. (See page 3-2 for a description of the DIP switch settings.)

The system always initializes the print buffer when you perform a print test. To perform a print test:

- Turn the power switch OFF
- Locate the two toggle switches on the Print Control board. The upper toggle switch is labeled LOAD and the lower toggle switch is labeled FEED.
- Set the LOAD switch up and hold the FEED switch up
- Turn power ON and release the FEED switch. The system prints a continuous test pattern (either the full character set or vertical lines) and initializes the print buffer.

To stop the print test, power OFF and then back ON again. To resume normal print functions, return the LOAD switch to the down position.

SECTION 4 - ERROR AND FORMAT CHANGE MESSAGES

If the Auto-Trend software detects an error or format change, it stops trending, prints the contents of the trend data report and issues a message that identifies the type of error or indicates a format change. Trending will not continue until all errors are corrected.

4.1 Error Messages

There are three types of error messages:

- Format Errors
- Length Errors
- Syntax Errors

Format Errors

When the system detects a format error, it prints:

**** GRAPHICS REPORT FORMAT ERROR ****

A format error occurs if:

- The first character in each header line is not an asterisk (*).
- Labels are not included in the trend data report. (Digit 1 of Configuration Code Address 0n6 must be 3.)
- The trend data report does not contain 2 rows of channel data. (Check digits 3-5 of Configuration Code Address 0n6.)
- The trend data report does not include the states of the relays and status inputs. (Digit 2 of Configuration Code Address 0n6 must be 1.)
- The trend data report does not contain the address of an ETX message or the ETX message is incorrectly defined. (Check digits 5-6 of Configuration Code Address 0n3. If digits 5-6 specify the address of an ETX message, check the text at that message to verify that 5D is stored there.)
- The digit that enables trending is not defined. (Digit 6 of Configuration Code Address 0n6 must be 1.)

The system will not trend or store any trend data until you correct the error. Only one format error message is issued, the system does not repeat the format error message if you enter an incorrect change. When all format errors are corrected, the system prints a format change message.

Length Errors

When the system detects a length error, it prints:

**** GRAPHICS REPORT LENGTH ERROR ****

A length error occurs if the length of the trend data report exceeds the maximum allowed. The system will not trend or store any trend data until you correct the error. When the error is corrected, the system prints a format change message.

Syntax Errors

When the system detects a syntax error, it prints:

**** GRAPHICS REPORT SYNTAX ERROR :: HEADER n ERROR mm ****

HEADER n indicates which header line (0-9) contains the syntax error. Header lines 1-9 refer to the nine lines of header information at the top of the trend data report. Header 0 refers to the message that follows the date/time.

ERROR mm (01-18) identifies the specific parameter causing the syntax error.

Table 2 lists the syntax error codes. The error codes identify the location of the error (header or date/time message), the number of the parameter causing the syntax error and a brief description of the error.

A syntax error also occurs if you select the European display format for the report data. Make sure that digit 2 of Configuration Code Address 006 is a zero.

The system will not trend or store any trend data until you correct the error. When all syntax errors are corrected, the system prints a format change message.

Table 2. Syntax Error Codes

Error Code (mm)	Error Location	Parameter Number	Error Description
01	Header	2	Format type
02	Header	3	Live trigger
03	Header	4	Historical trigger
04	Header	5	Interval of historical data before live trend
05	Header	6,7	Right/left X-axis margin
06	Header	8-19	Relative channel address
07	Date/Time Message*	1	Chart speed
08	Date/Time Message*	2	Print buffer
08	Date/Time Message*	3	Clear after
10	Date/Time Message*	4	Clear before
11	Date/Time Message*	5	Abbreviate trend
12	Header		Too many or too few parameters defined
13	Header		Incorrect parameter length or invalid character
14	Date/Time Message*		Too many or too few parameters defined
15	Date/Time Message*		Incorrect parameter length or invalid character
16	Header		Embedded blank in header
17	Date/Time Message*		Embedded blank in the Date/Time Message
18	Header		Included more channels in trend than format allows.

* The Date/Time message is header 0.

4.2 Format Change Messages

If you change the format or contents of the trend data report, the system prints the contents of the trend data report and the message:

**** GRAPHICS REPORT FORMAT CHANGE ****

The system also prints this messgae when you correct all format, length and syntax errors.

A correctly-entered format change does not inhibit trending or the storage of trend data.

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